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ABSTRACT

This teacher's guide is intended for use in helping Kodak Corporation employees develop the basic mathematics skills required to perform the manufacturing and quality control tasks expected of them. The following topics are covered in the first five modules: the four basic functions (adding, subtracting, multiplying, and dividing), calculations involving decimals, percentages, positive and negative numbers, and fractions. The sixth module reviews the topics covered in the preceding modules and helps students transfer the mathematics skills presented to applications on the shop floor. Each module includes some or all of the following: the module goal, an introduction, materials and guidelines for direct instruction, activities for use in guided practice, materials for use in applied practice, activities to develop critical thinking strategies, and a pretest and posttest. Transparency masters and student worksheets are included. (MN)

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ADULT EDUCATION PROGRAM
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ED 361 471

Kodak Skills Enhancement Program Curriculum:

Math for Manufacturing and Quality Control

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U.S. DEPARTMENT OF EDUCATION
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KODAK SKILLS ENHANCEMENT PROGRAM

KODAK COLORADO DIVISION
Windsor, Colorado

MATH FOR MANUFACTURING AND QUALITY CONTROL

TEACHER'S GUIDE

MATH FOR MANUFACTURING AND QUALITY CONTROL

Employees at Kodak Colorado Division are expected to perform a variety of tasks that require good math skills. Estimating, calculator use, finding per cent of change, plotting control charts, various word problems involving workplace examples, board graphics, averages, ranges, weekly totals, and total cost on control charts are all examples of these tasks. KCD employees are expected to produce effective math skills that are concise and correct.

There are many skills involved in effective workplace math that must be used collaboratively. Among these are the ability to employ:

* adding
* subtracting
* multiplying
* dividing
* functions with the calculator
* understanding place value of decimals
* interchanging fractions, decimals and percents
* positive and negative numbers
* understanding fractions

The realities of time availability and complex work schedules provide a challenge in delivering learning experiences that upgrade all of these skills.

These six modules address employee skills enhancement needs by providing essential information and instruction, appropriate practice and application, and resources for further directed learning in the math skills areas.

KODAK SKILLS ENHANCEMENT PROGRAM

MATH FOR MANUFACTURING AND QUALITY CONTROL

MODULE 1: ORIENTATION/ THE FOUR BASIC FUNCTIONS

ORIENTATION

Goal: To make students feel comfortable in the class, begin to form a group identity for interactive learning and to give an overview and pre assessment for the course.

Introductions
- Give background on teaching credentials and experience
- Students

Warm up Activity
- Two truths and a lie

Agenda - Show T1.1/LB1.1

Group Discussion
- Reasons for taking class
- Type of math used/needed on the job

Expectations
- What to do you expect to get from this class?
- Flip Chart - Record for customization
- Clarify unrealistic expectations

Norms
- Logistics for class, breaks, food, interaction, etc.

Assess, Plan, Do, Verify Process

Learning and activities in the class will be based on the Kodak Quality Process of Assess, Plan, Do and Verify. The first step is to assess

what needs to be done, what outcome is desired. (Asking for expectations of the class. Taking a self assessment and content pre assessment.) The second step is to plan how to achieve the desired outcome. (Customizing the course to meet the skill needs of the group and skill requirements of the job.) The third step is to carry out the plan. (Six modules of class time - lecture, interaction, practice.) The final step is to assess if the outcomes were achieved. (Group discussion, review, post self assessment and content assessment.)

Overview of Course Content - Show T1.2

Customizing the Curriculum - See list in Learner's Book

Ask individuals to volunteer to bring in blank and filled out copies of forms, charts, orders,etc. and examples of use of these job related math skills.

Self Assessment - See Assessment in Learner's Book

Students circle felt comfort and speed level at performing various math calculations

Pre Content Assessment

Benchmarking for progress
Helps with customizing curriculum
Screens out students who may only need particular modules

Break

(Correct tests)

Allow those students who scored high on the first module(s) to choose to stay for the review or come back at the appropriate module.

MODULE 1: THE FOUR BASIC FUNCTIONS

GOAL: To provide a review of the four basic functions (addition, substraction, multiplication, division) for student review and practice.

Direct Instruction

Overview of Module 1 - Show T1.3
Hand out Breakthrough to Math, Workbook for Level One

Introduce whole numbers
Introduce the number line - show positive and negative
Discuss place value - Worksheet 6

Addition and Subtraction

Flip Chart - Discuss vocabulary alluding to addition or subtraction and list in two columns on flip chart (possible examples: sum, more, include, total, increase - minus, cut off, difference, remain, etc.)

Present workplace situations/problems and ask if they would add or subtract.

Introduce number families for memorization. (Flash cards)
Brief review of multiple column addition, carrying (Breakthrough to Math: Level One Book 2 Adding Whole Numbers)

Brief review of multiple column subtraction, borrowing (Breakthrough to Math: Level One Book 3 Subtracting Whole Numbers)

Guided Practice

As each new concept is introduced and reviewed, give students a chance to explain aloud how problems on the board are solved. Provide timed practice answering questions from (parts of) selected worksheets in the workbook and give everyone the opportunity to demonstrate methods to the group from the board or flip chart. Worksheet 8 can be duplicated by student and used for home practice on any number families needing additional review.

Applied Practice

Daily Routine Computation Sheets
Ranges - Use familiar and job oriented contexts
Averages - Use familiar and job oriented contexts
Calculator practice

Critical Thinking Strategies

Estimating practice
Thinking strategies - grouping numbers equaling 10
Assess, Plan, Do, Verify - See Learner's Book
Give examples of workplace scenarios and practice

Break

Direct Instruction (and Guided Practice)

Multiplication and Division

Multiplication Facts

Practice in pairs with Multiplication Facts sheet (see Learner's Book)
Partner's highlight troublesome facts with highlighter

Group discussion - Discuss thinking stategies for remembering multiplication facts, 'tricks', especially 5's, 9's, 10's, 11's, 12's

Timed practice from Workbook Breakthrough to Math Level One:Book 5 Multiplying Whole Numbers

Multi-column multiplication
Lecturette presentation
Group/individual work at board
Selected practice from workbook
Practice with functional contextwork problems

Division
Review and practice division with one to four place numbers
Discuss appropriate times to use a remainder or carry out to decimals (from Kodak math examples)
Group work/board work/ workbook
Problem solving practice using Kodak example math problems

Applied practice/Thinking Strategies

Calculator practice
Estimating
Assess, Plan, Do, Verify with Functional Context
Choosing the right function (See Level One: Book 6)
What to you want to know? How will you set up calculations?
What function(s) do you need? Did you answer the right question?

1. Case weight is 54 lbs/ 6 units per case
Need 2 units/ What will they weigh?

2. Footage on roll is 8293 feet at start of defect. Instructions are to cut off film 100 feet before start of defect. What footage # is cut?

3. Total the following three cyclometer readings: 2000, 1293, 470.

4. What is the average number of defects per shift over the last three shifts? A shift - 15, B shift - 10, C shift - 5.

5. It is 60 miles from Denver to Fort Collins. As you are driving you see a sign for Fort Collins- 27 miles. How many miles have you driven?

6. James worked 12 hou shifts on Sunday and Monday and 8 hour shifts on Wednesday and Thursday. How many total hours did he work?

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PRE-TEST

1. Write *four-tenths*_____

2. Write *sixty-four thousandths*_____

3. 4.21 + .019 + 5 =

4. 3.765 - .02 =

5. .124 x .2 =

6. 3.451 x 1000 =

7. $4\overline{)18.4}$

8. $.4\overline{)18.4}$

9. 67.8 ÷ 10 =

10. Round .879 to the nearest hundredth

T2.1

THE CARDINAL RULE WHEN ADDING AND SUBSTRACTING DECIMALS

Line up the decimal points in a column!

If the number is whole, the decimal point comes at the right.

941.24 + .003 + 4 + 1,321.367=

941.240
.003
4.000
+ 1,321.367
2,266.610

T2.2

MULTIPLYING DECIMALS

1. Set up the problem as you would with whole numbers.
2. Do the multiplication.
3. Count the total number of decimal places in the problem.
4. Put the same number of decimal places in the answer.

32.04 (*two decimal places*)
x .321 (*three decimal places*)
10.28484 *(five decimal places)*

T2.3

DIVIDING DECIMALS BY WHOLE NUMBERS

1. Set up the problem as you would with whole numbers.

2. Place the decimal point on the answer line just above the decimal point in the division box.

3. Do the calculation.

$$4\overline{)24.8}\quad 6.2 \qquad\qquad 9\overline{).72}\quad .08$$

DIVIDING NUMBERS BY DECIMALS

1. Set up the problem as you would for whole numbers.

2. Remove the decimal point from the number outside the dividing box by multiplying by powers of 10 (moves the decimal to the right).

3. Multiply the number inside the dividing box by the same power of 10 (moves the decimal to the right the same number of places).

4. If the number inside the division box is a whole number, place the decimal point to the right of the last number and add zeros.

$$.7\overline{)5.6} \;\rightarrow\; 7\overline{)56}\quad 8$$

$$2.01\overline{)402} \;\rightarrow\; 2.01\overline{)402.00} \;\rightarrow\; 201\overline{)40200}\quad 200$$

T2.4

Quick Multiplication and Division by Powers of 10

When multiplying by 10's, 100's, 1000's, etc., move the decimal point to the right (value gets bigger) the same number of decimal places as there are zeros in the number you're multiplying by.

.3456 x 10 (one zero) = 3.456 (decimal moved right one place)

.3456 x 1000 (three zeros) = 345.6 (decimal moved right three places)

42.5 x 100 (two zeros) = 4250 (decimal moves right two places - after adding a zero)

When dividing by powers of 10, move the decimal point to the left (value gets smaller) the same number of decimal places as there are zeros in the number you're multiplying by.

678.4÷100 (two zeros) = 6.784 (left two places)

678.4÷10,000 (four zeros) = .06784 (left four places after adding a zero)

T2.5

ROUNDING OFF

Division problems don't always come out even. To finish the problem, you can round of to the nearest *tenth, hundredth, thousandth,* etc.

1. Look at the number to the right of the target place value.

2. If it is five or more, add one to the number in the target place value position.

3. If it is less than five, drop it and any numbers that come to the right of it.

3.456 becomes 3.46 when rounding to the nearest *hundredth*

46.0034 becomes 46.003 when rounding to the nearest *thousandth.*

BREAKING WASTE REPORT

Date_____

TUBS

	NUMBER OF TUBS BROKEN						
X-RAY EMULSIONS		x	0.11	x	$8.53	= $	
GRAPHIC EMULSIONS		x	0.23	x	$8.64	= $	
PAPER EMULSIONS		x	0.24	x	$8.01	= $	
MISC. GELS		x	0.04	x	$2.10	= $	
				TUB WASH WASTE TOTAL		= $	

CIA

	NUMBER OF CIA INITIAL FLUSHES					
X-RAY EMULSIONS		x	4	x	$8.53	=
GRAPHIC EMULSIONS		x	5	x	$8.64	=
PAPER EMULSIONS		x	3	x	$8.01	=
				CIA WASTE TOTAL		=

TUB WASTE		CIA WASTE		TOTAL BREAKING WASTE
	+		=	

POST-TEST

1. Write *six-tenths*_____

2. Write *thirty-six hundredths*_____

3. 5.23 + .023 + 7 =

4. 8.328 - .07 =

5. .124 x .2 =

6. 4.987 x 1000 =

7. $7\overline{)16.8}$

8. $.7\overline{)16.8}$

9. 54.97 ÷ 100 =

10. Round .467 to the nearest *tenth*

T2.0

MODULE 2

CALCULATING WITH DECIMALS

OBJECTIVES:

- UNDERSTANDING PLACE VALUE OF DECIMALS
- THE CARDINAL RULE OF DECIMALS
- ADDING, SUBTRACTING, MULTIPLYING AND DIVIDING
- QUICK MULTIPLICATION AND DIVISION BY POWERS OF 10
- ROUNDING
- FUNCTIONS WITH THE CALCULATOR

KODAK SKILLS ENHANCEMENT PROGRAM

MATH FOR MANUFACTURING AND QUALITY CONTROL

MODULE 2: CALCULATING WITH DECIMALS

GOAL: To be able to add, subtract, multiply and divide with decimals in order to solve workplace math problems.

Introduction

Warm up activity using decimals
Module overview and objectives - Show T2.0 and Learner's Book
Pre-test - Learner's Book

Direct Instruction

Hand out Breakthrough to Math Workbook for Level Two.

Place Values

Present and demonstrate place values on board
Group work - Worksheets 23, 24

Adding and Subtracting Decimals

The Cardinal Rule when adding and subtracting decimals - Show T2.1 and Learner's Book -

When setting up calculations for adding and subtracting decimals, the decimal points must always be lined up exactly.

Guided Practice

Individuals work at board and explain solutions
Individual and group work - Worksheets 25 and 26 (selected parts)

Direct Instruction and Guided Practice

Multiplying Decimals

Show relationship of decimals to fractions .1 x .1 = .01
Placing the decimal point correctly - Show T2.2 , Learner's Book

Group work, board work, individual work, Worksheet 27
Examples from Kodak work areas

Quick Multiplication and Division by Powers of 10

Show T2.4, Learners Book
Demonstrate moving the decimal to multiply and divide by 10's, 100's, 1000's, etc.
Group work with board, Worksheets 28, 32
Workplace examples
Mental math - group and individual work

Dividing Decimals

Demonstrate dividing decimals by whole numbers
Practice -group work at board and individual work
Worksheet 29
Demonstrate dividing decimals by decimals
Guided practice - board and Worksheet 30, 31
Review - show T2.3, Learner's Book

Rounding

Show T2.5, Learner's Book
Group practice
Individual practice, Worksheet 33

Applied Practice/Thinking Strategies

Using the calculator
Estimating
Asses, Plan, Do, Verify with word problems - Level Two: Book 6
Kodak Breaking Waste Report
Supply number of tubs broken/cia initial flushes
Calculate cost of waste for each emulsion or gel
Calculate tub wash waste total/cia waste total
Calculate total breaking waste
Post Test - Learner's Book

T3.2

PARTS OF A WHOLE

PERCENT DECIMAL FRACTION

FORMULA FOR FINDING A PERCENTAGE

1. $\frac{\text{PART}}{\text{WHOLE}} = \frac{\%}{100}$ DECIDE WHAT INFORMATION YOU HAVE IN THE FORMULA AND PLUG IT IN

a. 4 out of 5 is what percentage?

a. $\frac{4}{5} = \frac{\%}{100}$

b. $66 is 13% of what?

b. $\frac{\$\ 66}{\text{whole}} = \frac{13}{100}$

2. CROSS MULTIPLY

a. $4 \times 100 = 5 \times \%$
$400 = 5\%$

b. $\$66 \times 100 = 13 \times \text{whole}$
$\$6600 = 13\text{whole}$

3. DIVIDE BOTH SIDES BY THE VALUE NEXT TO THE UNKNOWN

a. $\frac{400}{5} = \frac{5\%}{5}$

$80 = \%$

b. $\frac{\$\ 6600}{13} = \frac{13\text{whole}}{13}$

$\$507.69 = \text{whole}$

MODULE 3

FINDING PERCENTAGES

OBJECTIVES:

- INTERCHANGING FRACTIONS, DECIMALS AND PERCENTS

- FORMULA FOR FINDING PERCENTAGES

- CALCULATING PERCENT OF CHANGE

KODAK SKILLS ENHANCEMENT PROGRAM

MATH FOR MANUFACTURING AND QUALITY CONTROL

MODULE 3: FINDING PERCENTAGES

GOAL: To be able to transfer between and among fractions, decimals and percents and to solve workplace problems which require calculation with percentages.

Introduction

Warm up activity - group percentages
Module overview and objectives - Show T3.1
Pre-test

Direct Instruction and Guided Practice

Introduce percentages

Parts of a Whole - formula and group practice
Show T3.2 , Learner's Book

Changing fractions to decimals
decimals to percents
fractions to percents
percents to decimals

Group work at board and individual practice on Worksheets 34-38

Finding the percents

Use formula to find percentage when looking for the part, the percentage or the whole - Learner's Book

Group work, board work, selected parts of Worksheets 39-44.

Finding the percent of change

Demonstrate multi-step process for finding % of change
Use functional context examples to solve problems from Kodak
Individual practice Worksheets 45-47

Critical Thinking Strategies/Applied Practice

Estimating the result
Calculator practice
Manipulating values among fractions, decimals and percents
Asses, Plan, Do, Verify with word problems - Level Two: Book 6

Post Test

MODULE 4

POSITIVE AND NEGATIVE NUMBERS

OBJECTIVES:

- NUMBER LINE, ABSOLUTE VALUE AND DIRECTION
- ADDING AND SUBTRACTING WITH POSITIVES AND NEGATIVES
- MULTIPLYING AND DIVIDING WITH POSITIVES AND NEGATIVES
- PLOTTING CONTROL CHARTS WITH POSITIVES AND NEGATIVES
- CALCULATING RANGES WITH POSITIVES AND NEGATIVES

MODULE 4

A FEW HOT TIPS FOR POSITIVE AND NEGATIVE NUMBERS

A negative number must be indicated by the use of a minus (-) sign. A positive number may be indicated by a plus (+) sign or no sign.

The absolute value of a number is the distance between that number and zero.

Signed numbers have both a distance and a direction.

Adding negative numbers

When you add two or more negative numbers the sum is negative.

When you add a positive and negative number the sum will be the absolute value of the larger minus the absolute value of the smaller with the sign of the number with the larger absolute value.

Subtracting negative numbers

When you subtract a number you add its opposite.

So....when you subtract a negative number you really add its absolute value.

Multiplying negative numbers

When multiplying two numbers with the same sign the result is always positive.

When multiplying numbers with two different signs the result is negative.

Dividing negative numbers

When dividing two numbers with the same signs the results are always positive.

When dividing two numbers with two different signs the results are always negative.

WHAT IS THE..... DISTANCE DIRECTION

-47 _____ _____

260 _____ _____

-1 _____ _____

23 _____ _____

-23 _____ _____

WHAT IS THE ABSOLUTE VALUE OF:

6

-6

.342

-11

-.25

ADD (combine)	The sum will be(+ OR-)
1. 10 + 10 =	_____
2. 10 + (-10) =	_____
3. -14 + 10 =	_____
4. 70 + (-10) =	_____
5. -100 + -100 =	_____
6. 75 + (-1) =	_____

SUBTRACT (combine)

1. 10 - (-50) =

2. 15 - (-100) =

3. 13 - (-17) =

4. 4 - (-20) =

5. -5 - (-5) =

6. -100 - (1000) =

* Clue: At what point does the problem start?

Try these:

7. -10 + (-10) =

8. -10 + 10 =

9. 10 - 10 =

10. 10 - (-10) =

If you can do 7 through 10 you've got it!!!!

MULTIPLY	The Result Will Be (+or-)
1. $2 \times (-2) =$	_____
2. $17 \times (-1) =$	_____
3. $8 \times (-9) =$	_____
4. $(-11) \times 9 =$	_____
5. $(-24)(-6) =$	_____
6. $(-11)(-10) =$	_____
7. $7(-12) =$	_____
8. $-12(-12) =$	_____
9. $60 \times (-5) =$	_____
10. $(-21) \times 7 =$	_____

DIVIDE	The result will be (+or-)
1. $10 \div (-2) =$	_____
2. $-10 \div (-2) =$	_____
3. $144 \div (-12) =$	_____
4. $72 \div (-8) =$	_____
5. $-99 \div (-9) =$	_____
6. $64 \div (-8) =$	_____
7. $-56 \div 7 =$	_____
8. $-108 \div (-12) =$	_____
9. $\frac{-96}{-12} =$	_____
10. $\frac{45}{-9} =$	_____

MASTERY CHECK

1. $5 + (-225) =$

2. $-30 + (-20) =$

3. $8 (-7) =$

4. $-63 \div (-7) =$

5. $(-9)(-21) =$

6. $\frac{-24(2)}{-12} =$

7. $-5 \times (-7) \times 2 =$

8. $\frac{56 \times (-2)}{-4} =$

9. $16 + 16 + (-16) =$

10. $96 \div (- 8) =$

11. $144 \div (-12) \times 3 =$

Check yourself: Do you know the rules for + and - numbers?
Do you know the multiplication facts ?
What do you think you need more work in?

KODAK SKILLS ENHANCEMENT PROGRAM

MATH FOR MANUFACTURING AND QUALITY CONTROL

MODULE 4: POSITIVES AND NEGATIVES

GOAL: To understand positive and negative numbers in relation to each other, be able to calculate with addition, subtraction, multiplication and division with positive and negative numbers, and be to apply the concepts taught to workplace problem solving at Kodak.

Introduction

Group warm up activity with positives and negatives
Module overview and objectives - Show T4.1

Direct Instruction

Addition and Subtraction

Lecturette on number line - Introduce concept of adding and substracting positive and negative numbers (no written calculations)
- Using checkbook positives and negatives
- Using direction and distance
- Using temperature

Introduce range with + and -
Introduce notation ( )

Show same problems and solutions with written calculations
Absolute value explanation
Hot Tips Sheet (Learner's Book)

Guided Practice

Group and board work with adding with signs the same
Group and board work with adding when signs are different
Group and board work with adding more than two signed numbers

Direct Instruction

Demonstrate subtracting with signed numbers
- both negative
- mixed
- more than two

Guided Practice

Group and board work with subtracting
Individual work with adding and subtracting signed numbers
(Learner's Book)

Direct Instruction

Multiplication and Division

Hot Tips Sheet (Learners' Book)
Sign cancellation rule
Board demonstrations

Guided Practice

Group and board work on multiplying and dividing positive and negative numbers

Individual work from activity sheets (Learner's Book)

Applied Practice

Plot, graph and interpret values on Kodak control chart (Learner's Book)
Calculate averages, ranges, weekly totals and total cost on control charts using positive and negative numbers
Discuss trends, in control and out of control conditions

Calculator Use

Critical Thinking Strategies

Mental math using functional context problems
Estimating (ranges, totals, differences)

KODAK SKILLS ENHANCEMENT PROGRAM

MATH FOR MANUFACTURING AND QUALITY CONTROL

MODULE 5: UNDERSTANDING FRACTIONS

GOAL: To understand fractions and their relation to decimals and percentages and to be able to solve workplace problems that require calculations with fractions.

Introduction

Warm up activity - Group fraction (Number of children, years of service, color of eyes, hair, etc.

Overview of module objectives - Show T5.1
Pre-test - concepts

Direct Instruction and Guided Practice

Understanding fractions

Lecturette, demonstration, board work, group discussion
- Introduction of concept of fractions - board graphics
- Common fractions and their equivalents in decimals and percentages
- Reading fractions - numerators and denominators
- The number 1 in fractions
- Showing whole numbers

Individual work Worksheets 1-2

Lecturette, demonstration
- **Improper and proper fractions**
- Changing improper to mixed fractions
- Changing mixed to improper fractions

Board work with group, individual work Worksheets 3-4 (selections)

Lecturette, demonstration

Equivalent fractions

Reducing fractions to lowest terms

Board work with group, individual work on Worksheets 5-6 (selected parts)

Post test - concepts

Break

Direct Instruction and Guided Practice

Pretest - multiplication and division

Multiplying and Dividing Fractions

Lecturette and demonstration

Hot Tips for Calculating with Fractions - T5.2, Learner Book

Multiplying Fractions, fractions and whole numbers

When multiplying fractions, multiply the numerator and denominator straight across. No adjustments are needed.

Cancelling

Reduce fraction first or cancel diagonally

Multiplying with mixed numbers

Group work at board, individual work on Worksheets 18-20

Lecturette and demonstration

Dividing fractions

When dividing a number by a fraction, multiply by the inverse of that fraction (Reduce and cancel before multiplying)

Dividing with mixed numbers

Group work at board, individual work from selected parts of Worksheets 21 and 22

Post test - Multiplication and Division

Break

Direct Instruction and Guided Practice

Pretest - Additing and Subtracting Fractions

Finding common denominators - lecturette, demonstration

1. See if the larger denominator can be divided equally by the smaller denominator(s).
2. If two denominators, multiply the denominators.
3. If three or more denominators, multiply the largest denominator by 2,3,4,5,6, up to 10 and check to see if the product can be divided equally by the smaller denominators. If not, multiply all the denominators together.

Comparing fractions by making equivalent fractions

Group work at board, individual practice on Worksheets 7 & 8.

Adding Fractions

Lecturette and demonstration, group work at board and individual work on selected parts of Worksheets 9-11

Adding fractions with the same denominator
Adding fractions with different denominators
Adding mixed numbers

Subracting fractions

Lecturette and demonstration, group work at board and individual work on selected parts of Worksheets 13-17

Subtracting fractions with the same denominator
Subtracting fractions with different denominators
Subtracting mixed numbers
Borowing with fractions
- Same denominator
- Different denominators
- Mixed numbers

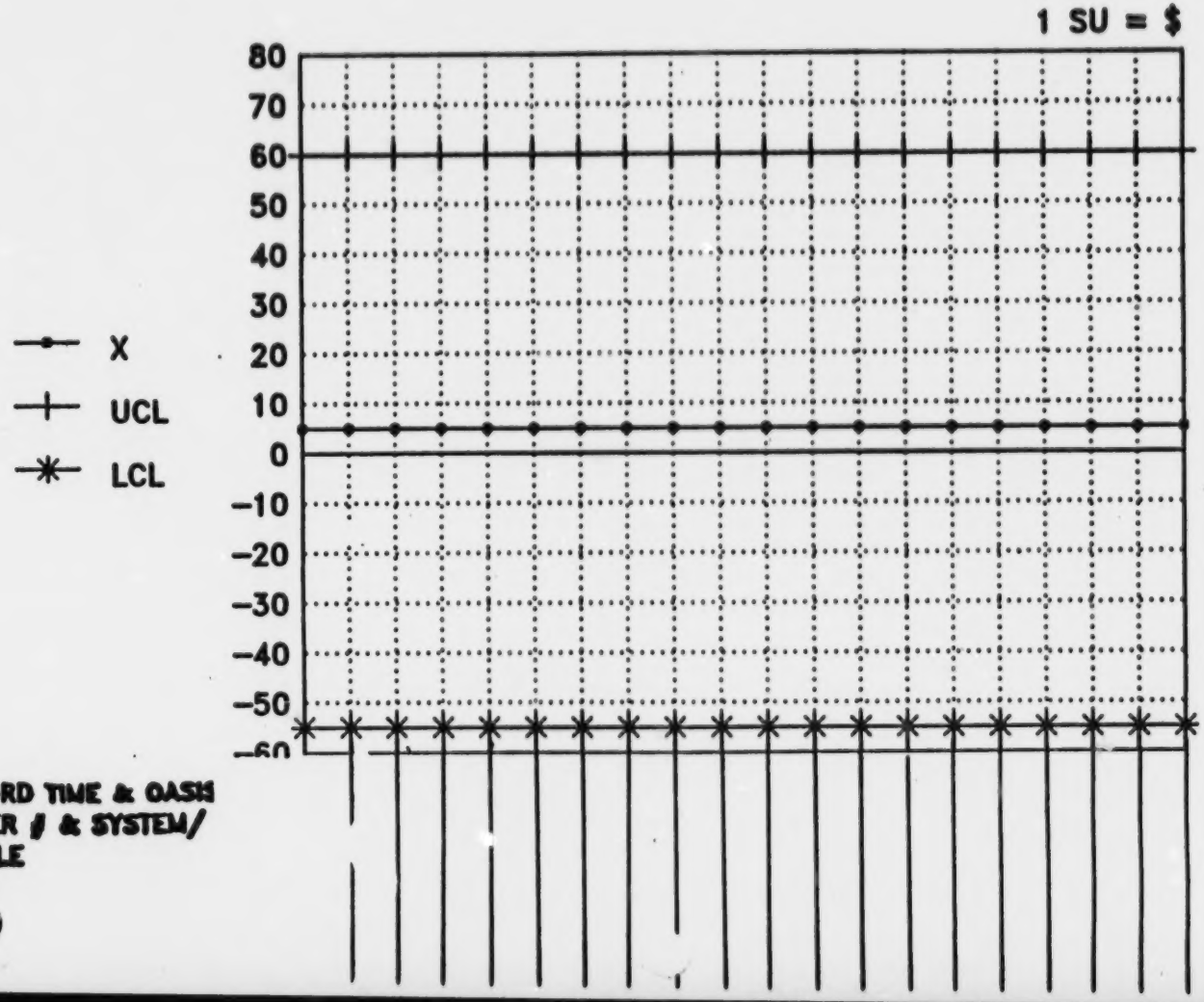
Review Hot Tips sheet - Learner's Book
Post test - addition and subtraction

Critical Thinking Strategies/Applied Practice

Discuss individual styles, 'tricks', for finding common denominators
Estimating
Calculator Practice - changing fractions to decimals
Assess, Plan, Do, Verify with word problems Level Two:Book 6
Breakthrough to Math
Kodak work problems/scenarios

S.U. CONTROL CHART DATE:

X–RAY

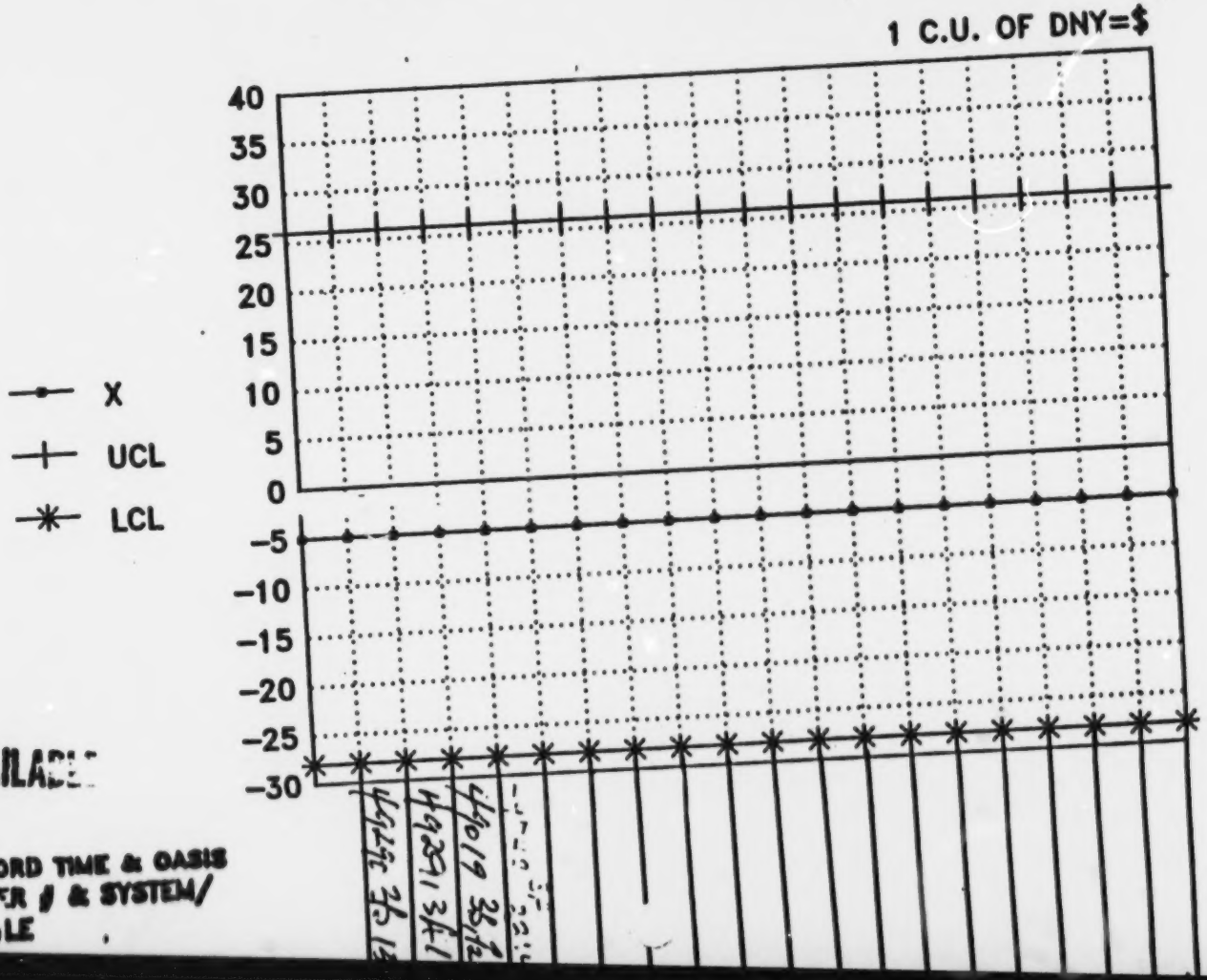


RECORD TIME & OASIS ORDER # & SYSTEM/ KETTLE

C.U. CONTROL CHART

DATE:

DNY LAYER



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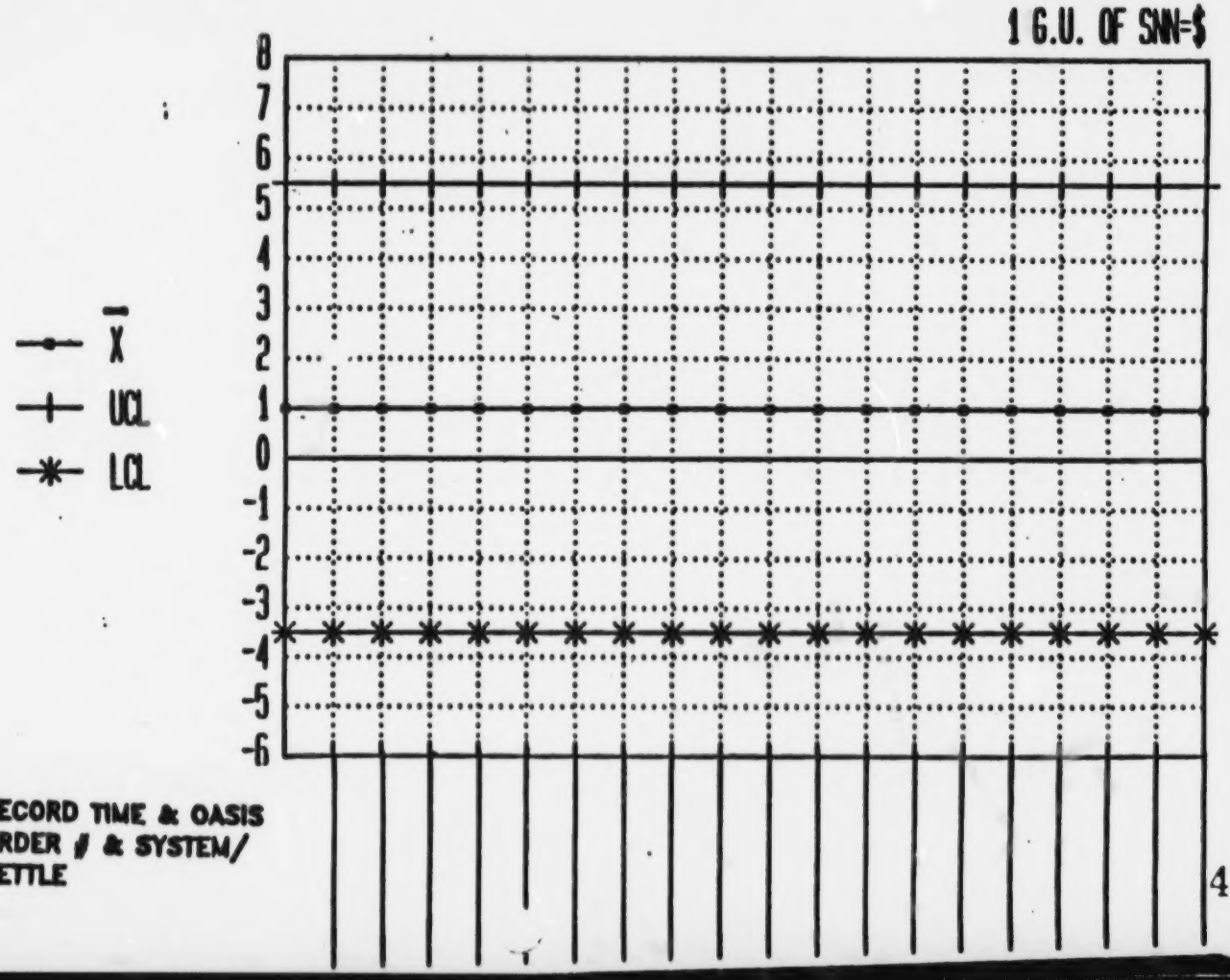
43

G.U. CONTROL CHART DATE:

SNN LAYER



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KODAK SKILLS ENHANCEMENT PROGRAM

MATH FOR MANUFACTURING AND QUALITY CONTROL

MODULE 6: REVIEW

GOAL: To review the content taught in the six modules and to be able to transfer the skills and knowledge learned to applications on the shopfloor. To assess attainment of skills taught.

Introduction

Warm up activity
Module overview and objectives - Show T6.1

Direct Instruction and Guided Practice

Paired practice with multiplication tables

Review:

Four basic functions
Decimal calculations
Formula for finding percentages
Calculating with positive and negative numbers
Averages and Ranges
Fraction manipulation

With each new topic, allow ample time for questions, additional practice from the workbook, and board explanation and practice.

Use the functional context material gathered throughout the course to develop examples of problems in each area for board work.

Cover additional requested topic as time is available

Basic algebra
Converting metric to standard measurements

Review:

Estimating
Calculator use with each type of calculation
Thinking Strategies
Assess, Plan, Do, Verify with word problems
Give students practice choosing the correct function(s) needed to solve work related problems

Feedback/Assessment

Students fill in post self-assessment felt comfort levels
Circle new comfort levels on pre self-assessment from f Module 1 and mark direction of change from initial assessment.

Post content assessment

Correct tests and give feedback and progress information to students before they leave.

Closure. Recommendations for further training

T1.1
LB1.1

KODAK SKILLS ENHANCEMENT PROGRAM

MATH FOR MANUFACTURING AND QUALITY CONTROL

MODULE 1: ORIENTATION

OBJECTIVES:

- introductions
- overview of module content areas
- logistics
- norms and expectations
- self assessment

T1.2
LB1.2

KODAK SKILLS ENHANCEMENT PROGRAM

MATH FOR MANUFACTURING AND QUALITY CONTROL

MODULE 1: ORIENTATION/ THE FOUR BASIC FUNCTIONS

MODULE 2: CALCULATING WITH DECIMALS

MODULE 3: FINDING PERCENTAGES

MODULE 4: POSITIVE AND NEGATIVE NUMBERS

MODULE 5: UNDERSTANDING FRACTIONS

MODULE 6: CHARTING/REVIEW/CLOSURE

(Content and order subject to change based on needs of participants.)

KODAK SKILLS ENHANCEMENT PROGRAM
MATH FOR MANUFACTURING AND QUALITY CONTROL

CUSTOMIZING THE CURRICULUM

Please help us customize the curriculum to meet your workplace needs by bringing samples of some of the following workplace materials to the next class meeting.

In any case where there is both a filled out form and a blank form of any of type of material, please bring in both forms. Feel free to white out names.

SPC (Statistical Process Control) charts
Schedules that you need to figure percentages on
Examples of situations where you have to figure footages run on print machines
Data query print outs of schedules (Totals and percentages)
Examples of figuring waste

Forms or examples where you would convert footage of film to spools, rolls, units
Orders that you balance (Justify difference between expected yield and actual yield)
Percent yield calculations (for emulsions)
Plotting information
Charts, graphs, lists, diagrams, etc. involving numbers and calculations

Number Matrices
Metric conversion charts
Transfer functions
Control chart information you need to plot
Electronic time cards for figuring work hours

Supply orders (for calculating supplies)
Item level compliance information
Inventory control sheets
Invoices
Purchase orders

Inventory records/monthly inventory reports
Process for allocating/deploying products evenly to customers
Forms involved in figuring weights needed for air shipments to determine appropriate carrier (transportation)
Rate work/rate comparison materials
Equipment calibration sheets

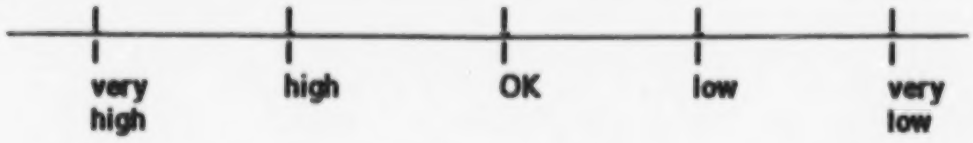
Calculations for making adjustments to chemical mixture or concentrations (Dye/Doctors)
Su/Kg percent from aim
pH, VAg difference from aim
Adjusted jar volumes
Density conversions (kilograms to pounds)

Figuring excess grams per liter
Any type of control chart (scales, SU, waste, CPS,etc.)
Waste charts (winder, coating, melting,etc.)
Flow calculations
Continuous improvement matrix

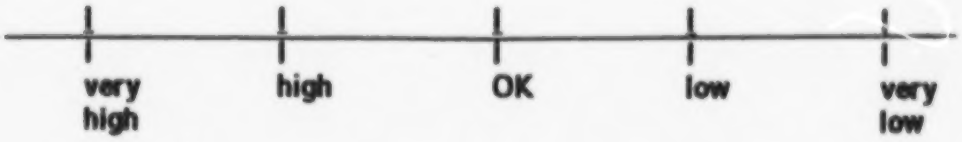
KODAK SKILLS ENHANCEMENT PROGRAM
MATH FOR MANUFACTURING AND QUALITY CONTROL

SELF ASSESSMENT

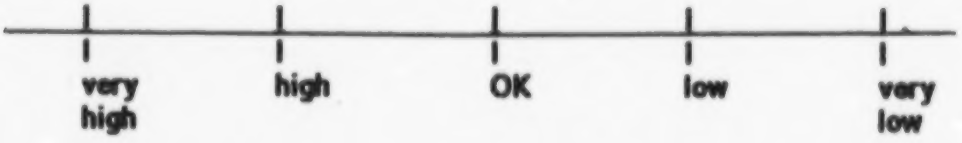
1. I would rate my comfort level and speed at adding, subtracting, multiplying and dividing whole numbers (including calculating averages and ranges) as:



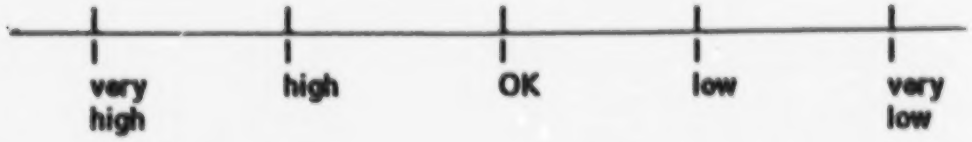
2. I would rate my comfort level and speed at performing calculations with negative numbers (including averages and ranges) as:



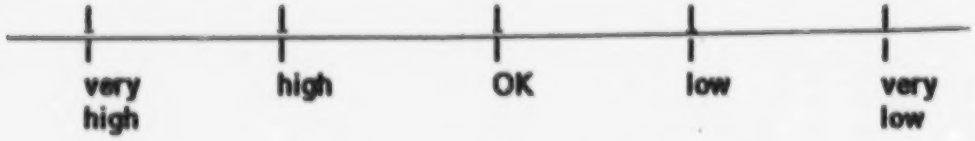
3. I would rate my comfort level and speed at performing calculations with percentages as:



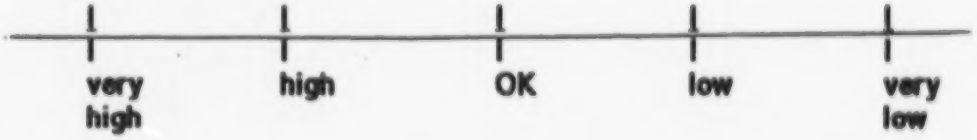
4. I would rate my comfort level and speed at performing calculations with decimals as:



5. I would rate my comfort level and speed at performing calculations with fractions as:



6. I would rate my comfort level and speed at plotting data on process control charts as:



KCD

MATH FOR MANUFACTURING AND QUALITY CONTROL
LOCATOR TEST

MODULE 1

1. $\begin{array}{r} 23 \\ \times 46 \end{array}$

2. $\begin{array}{r} 437 \\ -\ 89 \end{array}$

3. 40 640

MODULE 2

1. $(-10) + 4 =$

2. $35 - (-5) =$

3. $(-4)(3)(-2) =$

MODULE 3

1. $.01 + 3 + 2.4 + \ =$

2. $\begin{array}{r} 3.5 \\ \times .02 \end{array}$

3. .24 48

MODULE 4

1. $\frac{3}{5}$ = What % ?

2. What percent of 40 is 8?

3. Write .07 as a percent.

MODULE 5

1. $\frac{5}{8} \times \frac{4}{5} =$

2. $\frac{1}{3} + \frac{3}{4} =$

3. $\frac{1}{2} \quad \frac{2}{3} =$

T1.3
LB1.3

KODAK SKILLS ENHANCEMENT PROGRAM

MATH FOR MANUFACTURING AND QUALITY CONTROL

MODULE 1: THE FOUR BASIC FUNCTIONS

OBJECTIVES:

- INTRODUCTION TO WHOLE NUMBERS
- ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION
- RANGES AND AVERAGES
- IDENTIFYING WHEN TO CHOOSE A FUNCTION
- ESTIMATING, VERIFYING RESULTS
- CALCULATOR PRACTICE

KCD

MATH FOR MANUFACTURING AND QUALITY CONTROL

ASSESS * PLAN * DO * VERIFY

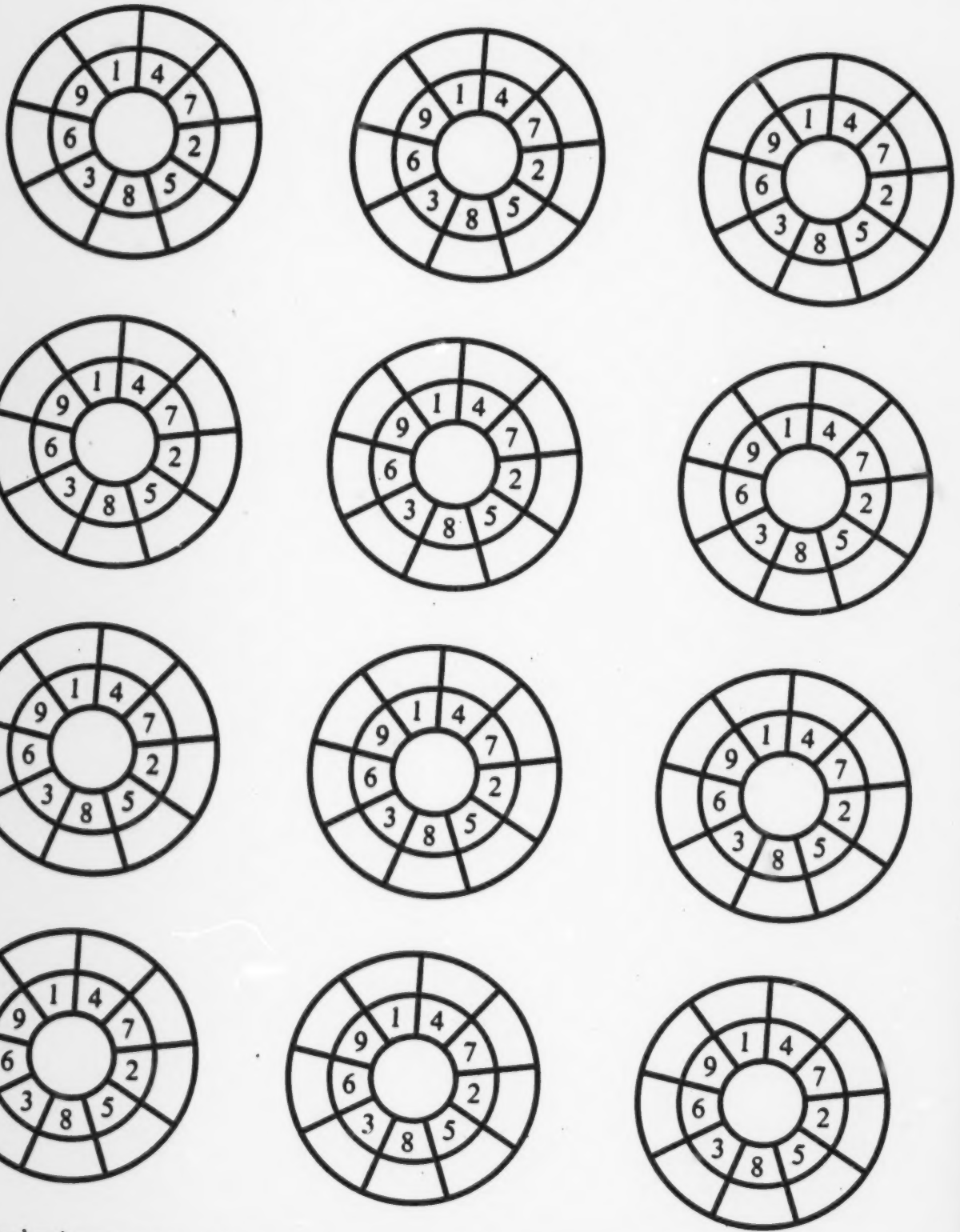
1. ASSESS
   What result am I looking for?
   What is the expected outcome?

2. PLAN
   What data do I have?
   What data do I need to solve the problem?
   What calculations should I use?

3. DO
   Set up the problem.
   Do the calculations and check the accuracy.

4. VERIFY
   Did I answer the right question?
   Is my answer reasonable?

Worksheet 8



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DAILY ROUTINE COMPUTATIONS SHEET

14,000' Roll Lengths

OK to turn on gel flush water
10,000

EXAMPLE ONLY!!!

Stripping Roll	#1 U-Coat	#2 U-Coat
14,100	14,100	14,100
- 2661	- 2348	- 2094

#2 Defect Detector	5X Hopper	6X Hopper
14,100	14,100	14,100
- 1478	- 1310	- 1137

#2 Slitter	Knurls & High Tension
14,100	14,100
- 336	- 316

DAILY ROUTINE COMPUTATIONS SHEET

14,000' Roll Lengths

OK to turn on
gel flush water
10,000

EXAMPLE ONLY!!!

Stripping Roll	#1 U-Coat	#2 U-Coat
14,100	14,100	14,100
- 2661	- 2348	- 2094
11,439	11,752	12,006

#2 Defect Detector	5X Hopper	6X Hopper
14,100	14,100	14,100
- 1478	- 1310	- 1137
12,622	12,790	12,963

#2 Slitter	Knurls & High Tension
14,100	14,100
- 336	- 316
13,764	13,784

DAILY ROUTINE COMPUTATIONS SHEET

7150' Roll Length

OK to turn on
gel flush water
3,000

EXAMPLE ONLY!

Stripping Roll	#1 U-Coat	#2 U-Coat
7250	7250	7250
- 2661	- 2348	- 2094

Cleaning Station	5X Hopper	6X Hopper
7250	7250	7250
-1478	-1310	-1137

#2 Slitters	Knurls & Auto High Tension
7250	7250
- 336	- 316

MODULE #420
DATE:01/29/92

DAILY ROUTINE COMPUTATIONS SHEET

9120' Roll Lengths

OK to turn on
gel flush water
5,000

EXAMPLE ONLY!

Stripping Roll	#1 U-Coat	#2 U-Coat
9220	9220	9220
- 2661	- 2348	- 2094
6559	6872	7126

2 Defect Detector	5X Hopper	6X Hopper
9220	9220	9220
-1478	-1310	-1137
7742	7910	8083

#2 Slitters	Knurls & High Tension
9220	9220
- 336	- 316
8884	8904

DAILY ROUTINE COMPUTATIONS SHEET

9120' Roll Lengths

OK to turn on
gel flush water
5,000

EXAMPLE ONLY!

Stripping Roll	#1 U-Coat	#2 U-Coat
9220	9220	9220
- 2661	- 2348	- 2094

2 Defect Detector	5X Hopper	6X Hopper
9220	9220	9220
-1478	-1310	-1137

#2 Slitters	Knurls & High Tension
9220	9220
- 336	= 316

DAILY ROUTINE COMPUTATIONS SHEET

7150' Roll Length

OK to turn on
gel flush water
3,000

EXAMPLE ONLY!

Stripping Roll	#1 U-Coat	#2 U-Coat
7250	7250	7250
- 2661	- 2348	- 2094
4589	4902	5156

Cleaning Station	5X Hopper	6X Hopper
7250	7250	7250
-1478	-1310	-1137
5772	5940	6113

#2 Slitters	Knurls & Auto High Tension
7250	7250
- 336	- 316
6914	6934

MULTIPLICATION FACTS

1 X 1 = 1	3X1=3	5X1=5
1 X 2 = 2	3X2=6	5X2=10
1 X 3 = 3	3X3=9	5X3=15
1 X 4 = 4	3X4=12	5X4=20
1 X 5 = 5	3X5=15	5X5=25
1 X 6 = 6	3X6=18	5X6=30
1 X 7 = 7	3X7=21	5X7=35
1 X 8 = 8	3X8=24	5X8=40
1 X 9 = 9	3X9=27	5X9=45
1 X 10 = 10	3X10=30	5X10=50
1 X 11 = 11	3X11=33	5X11=55
1 X 12 = 12	3X12=36	5X12=60

2X1=2	4X1=4	6X1-6
2X2=4	4X2=8	6X2=12
2X3=6	4X3=12	6X3=18
2X4=8	4X4=16	6X4=24
2X5=10	4X5=20	6X5=30
2X6=12	4X6=24	6X6=36
2X7=14	4X7=28	6X7=42
2X8=16	4X8=32	6X8=48
2X9=18	4X9=36	6X9=54
2X10=20	4X10=40	6X10=60
2X11=22	4X11=44	6X11=66
2X12=24	4X12=48	6X12=72

MULTIPLICATION FACTS

7 X 1 = 7	9X1=9	11X1=11
7 X 2 = 14	9X2=18	11X2=22
7 X 3 = 21	9X3=27	11X3=33
7 X 4 = 28	9X4=36	11X4=44
7 X 5 = 35	9X5=45	11X5=55
7 X 6 = 42	9X6=54	11X6=66
7 X 7 = 49	9X7=63	11X7=77
7 X 8 = 56	9X8=72	11X8=88
7 X 9 = 63	9X9=81	11X9=99
7 X 10 = 70	9X10=90	11X10=110
7 X 11 = 77	9X11=99	11X11=121
7 X 12 = 84	9X12=108	11X12=132

8X1=8	10X1=10	12X1=12
8X2=16	10X2=20	12X2=24
8X3=24	10X3=30	12X3=36
8X4=32	10X4=40	12X4=48
8X5=40	10X5=50	12X5=60
8X6=48	10X6=60	12X6=72
8X7=56	10X7=70	12X7=84
8X8=64	10X8=80	12X8=96
8X9=72	10X9=90	12X9=108
8X10=80	10X10=100	12X10=120
8X11=88	10X11=110	12X11=132
8X12=96	10X12=120	12X12=144